

# Observations on the reproductive Biology and early postnatal development of the Panther, *Panthera pardus* L., in captivity<sup>1</sup>

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(With three text-figures)

## INTRODUCTION

Among the big cats, the panther is the most widely distributed species over the world (Walker 1964). Like the tiger it has been subjected to an increasing hunting pressure and persecution from the last century. In the recent past it has declined noticeably in peninsular India and is mostly found in certain favourable localities such as sanctuaries and is almost rare in many places where it was common formerly (Krishnan 1972). Considerable information regarding its habits, habitat and hunting technique is available from the records of hunters and naturalists, but little is known of its breeding habits in the wild.

Considering the secretiveness of the panther it is little wonder that such information is notably lacking in literature. However, in view of its importance as one of the major predators, a knowledge of the reproductive biology is essential background information. This study was undertaken to provide information (1) on the reproductive behaviour of the panther; (2) to ascertain the duration of oestrus, breeding season, gestation period and size of litter; and (3) to provide comparative data on the early postnatal development of the panther. This paper is based on data collected at the Delhi Zoological Park from 1958 to 1973 and on comparative records available from various other zoos.

## MATERIALS AND METHODS

The Delhi Zoological Park was officially opened to the public on

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1st November 1959 but work on the zoo had started in 1955. In 1956 the zoo received four panther cubs as presents from different sources. The Delhi zoo was successful in breeding panthers for the first time in 1960, when a litter of two cubs was born on 29th May. Until May 1973, 63 panther cubs had been born to nine pantheresses.

The panthers at the Delhi Zoological Park are kept in spacious enclosures which provide sufficient room for exercise. Each enclosure has small cells at the back where the panthers are shut in during the night. The floors of the cells are cemented but wooden platforms are provided as warm resting places.

The panthers are fed six days in a week on buffalo calf meat and on Friday of each week no food is given. On average, an adult panther is given 5 kg of fresh raw meat with bones daily, but the quantity is adjusted according to the size, age and general condition of the animal.

For the purpose of this study, data have been drawn from my own observations from 1963 onward, supported by the records maintained at the Delhi Zoological Park in the form of individual animal history cards, daily observation reports and Head Animal Keepers' registers.

The measurements of seven newly born cubs were recorded within twelve hours after their birth. The early postnatal growth of one cub was recorded from the time of birth till the age of four months, when it had weaned completely; and that of other two cubs till the age of two months. All the three cubs were raised by their respective mothers.

Comparative data on early postnatal development of the cubs were derived from Zurich zoo (Weillenmann 1963); New York zoo (Crandall 1964) and Sao Paulo zoo, Brazil (Carvalho 1968).



Fig. 1. Frequency distribution of oestrus periods and birth of Panther cubs.

## BREEDING SEASON

Panthers breed all the year round (Prater 1971). Between the years 1828 and 1961, panthers had bred during all seasons at Whipsnade and Regent's Park (Jarvis & Morris 1962). It has been stated that in India panther cubs are born between February and March (Blandford 1888-91).

At the Delhi Zoological Park the females come in oestrus during all the months of the year (Fig. 1). From 1958 to 1973, 55 oestrus or heat-periods of nine females have been recorded, during which these females were mated several times by the males and from 1960 to 1972, 63 cubs were born in 39 litters. These data are presented in Table 1.

TABLE 1  
BREEDING SEASON OF PANTHER, *Panthera pardus*, IN CAPTIVITY

Months	Number of oestrus or heat-periods	Percentage	No. of litters born	Percentage
January	4	7.3	5 (8)	12.8
February	6	10.9	1 (2)	2.5
March	6	10.9	—	—
April	9	16.4	3 (5)	7.7
May	5	9.9	6 (9)	15.4
June	4	7.3	4 (4)	10.3
July	4	7.3	7 (12)	17.9
August	1	1.8	2 (3)	5.1
September	4	7.3	4 (7)	10.3
October	6	10.9	4 (7)	10.3
November	4	7.3	1 (3)	2.5
December	2	3.6	2 (3)	5.1
Total	55	100	39 (63)	100

Figures in bracket indicate number of cubs.

## DURATION OF OESTRUS

Behaviour such as willingness to be stroked by their keepers, increased rubbing on bars and walls of the cages, repeated rolling over on the back indicate that the female is in oestrus (Sadlier 1966). The duration of oestrus was taken as the total number of days on which the above behaviour of a female was recorded and when she permitted mounting and copulation by the males.

Available data on the oestrus periods of 9 adult pantheresses show a wide range of variation (Table 2).

TABLE 2

BREEDING BIOLOGY OF PANTHER, *Panthera pardus*, AT DELHI ZOOLOGICAL PARK

Specimen	No. of oestrus periods	Range of oestrus (days)	Average oestrus period (days)	Average of last day of oestrus to birth (days) (gestation period)	Average number of cubs/litter
Budhi	9	6-12	9	92.2 (5)	1.6 (6)
Tara	7	4-10	7.4	94.6 (3)	1.7 (4)
Heer	3	5-10	5.0	91.0 (2)	1.7 (4)
Rani	4	7-13	7.5	91.0 (3)	1.6 (5)
Vimla	6	6-12	8.5	93.6 (3)	1.6 (5)
Ganga	3	8-11	10.0	93.0 (2)	1.0 (2)
Kali	7	6-12	8.1	—	—
Meenu	9	7-12	8.0	93.0 (5)	1.6 (11)
Jamuna	7	8-14	10.0	87.5 (2)	1.5 (2)

Figures in brackets indicate number of litters.

## SEXUAL MATURITY

Mivart (1881) reports that the domestic cat becomes reproductively mature at the age of one year. The Scottish wild cat breeds first when about 12 months old (Mathews 1941). Sankhala (1967) states that tiger cubs mature at an age between 3½ and 6 years. Young female lions become cyclic at the age of about 3 years, while males appear to require several months longer to achieve sexual maturity (Crandall 1964).

One pantheress (Tara) came into oestrus for the first time at the age of 1 year and 8 months at the Delhi Zoological Park. Another pantheress (Ganga) became cyclic at the age of 2 years 11 months and Heer and Jamuna did so at the age of 3 years 2 months and 3 years 3 months respectively. Two females Meenu and Rani littered for the first time at the age of 2 years 3 months and 2 years 9 months respectively (Table 3). One male Ajay mated for the first time at the age of 2 years.

TABLE 3

OBSERVATIONS ON SEXUAL MATURITY OF PANTHER, *Panthera pardus*, AT DELHI ZOOLOGICAL PARK

Specimen	Date of birth	Date of first oestrus	Age at which observed in oestrus for the first time	Date on which first litter was born	Age at which littered for the first time
Tara	20.8.56	5.4.58	1 - 8	5.8.60	4 - 0
Ganga	15.4.63	5.3.66	2 - 11	15.6.66	3 - 2
Heer	March 56	24.5.59	3 - 2	29.5.60	4 - 2
Jamuna	15.4.63	3.7.66	3 - 3	—	—
Meenu	27.4.58	Records not available		11.7.60	2 - 3
Rani	Oct. 58	Records not available		18.7.61	2 - 9
Budhi	24.5.57	10.3.61	3 - 10	18.6.61	4 - 1

## MATING BEHAVIOUR

Properly adjusted and well-mated pairs of panthers breed freely in captivity but attempts to introduce mature specimens to each other are not without risks of injury (Crandall 1964). When any female comes in oestrus at the Delhi Zoological Park, a male is put in the adjoining cage from where the two can see and smell each other. If both show signs of compatibility, it is assumed that they will accept each other and subsequently both are introduced to each other in a large enclosure. They approach each other very cautiously. The muscles of both animals remain taut and they continually growl and snarl at each other. After some time they relax and gradually come closer, till they are face to face. They sniff each other. When mutual confidence is established, the female starts rolling on her back in front of the male and presents herself. She sits with her forelimbs extended fully on the ground, her hind limbs remaining half bent. The male approaches from behind and mounts, and his first insertion takes place within 4 to 8 seconds. Actual coition time varies from 10 to 50 seconds. During coition, the animals emit a variety of guttural sounds. As the climax of the act approaches, the male firmly holds the skin of the female's nape between his incisors and both panthers make a high-pitched sound. As soon as copulation is complete, the male dismounts quickly or is thrown off. Sometimes a short scuffle takes place. After each copulation the female lies flat on the ground for some time. After a short interval, the female again approaches the male, and the whole process is repeated.

During the peak of oestrus copulation takes place 5 to 60 times between 8.00 a.m. and 5.00 p.m. At this time the male and female are both unconcerned about any other activity and show no interest even in the food offered to them.

As stated earlier, bringing male and female together in zoos is not without risk. Sometimes the partners behave aggressively and one of them may be seriously injured or even killed by the other. In June 1967, one of the females Rani was introduced to a male Milu. For some time they behaved very well, but suddenly the male, which was heavier and bigger, caught hold of the female, and a serious fight took place. Rani died of injuries two days later.

## GESTATION PERIOD

The gestation period of the panther is given as 90 to 100 days or 98 to 105 days by Kenneth (1953). Asdell (1946) records it as being 92 to 95 days and Pocock (1939) notes a gestation period of 102 days for an African leopard at Whipnade Park Zoo as being exceptional. Cran-

dall (1964) gives one gestation length for a black leopard as 90 days from the middle of the heat period. Sadlier (1966) notes 100 day gestation period for two litters of the Chinese leopard from the second day of oestrus. The longest gestation period of the species is recorded as 112 days, at Prague zoo (Dobroruka 1968). Prater (1971) gives the gestation period as 13 weeks. It is difficult to compare the above data as in most cases the date of conception is defined differently. For purposes of this study, the duration of gestation is estimated as the period from last day of mating to birth, and the mean period was 91.9 days, the extremes being 84 and 98 (Table 2).

#### LITTER SIZE

Prater (1971) records that two to four cubs are usually produced. Dobroruka (1968) states that over a period of 15 years at Prague zoo, three young have been born on only two occasions. One was born in two instances and two in seven instances. Jobaert (1960) mentions that in the Congo leopards give birth to two or three young. Zuckermann (1953) records one to three young per litter in the Zoological Gardens of London from 1839 to 1937. According to Pushp Kumar (Curator, Nehru Zoological Park, Hyderabad), usually one to two cubs have been born in a litter at the Nehru Zoological Park, three cubs have only been born on two occasions (pers. comm.).

Data on 39 litters at the Delhi Zoological Park indicate that two cubs per litter were born on twenty occasions, one on seventeen occasions and only in two instances were three young born. The average was 1.6 cubs per litter (Table 2).

#### POSTNATAL DEVELOPMENT OF THE YOUNG

The panther cubs born in the New York and Zurich zoo weighed 0.567 kg and 0.430 kg at birth respectively as recorded by Crandall (1964) and Weillenmann (1963).

The weights and measurements of seven cubs at Delhi Zoological Park indicate that a newly born cub weighs approximately 0.500 kg to 1.00 kg and measures 360 mm to 483 mm from tip of nose to tip of tail between pegs (Table 4). All cubs were born with their eyes closed.

TABLE 4

MEASUREMENTS OF CUBS OF *Panthera pardus*, RECORDED WITHIN TWELVE HOURS AFTER BIRTH

Date of birth	Sex	Weight in kg	Total length in mm	Tail length in mm	Ear length in mm	Forefoot in mm
29.1.66	Male	1.000	483	181	25	103
25.6.66	Male	0.750	360	130	—	75
29.9.66	Female	0.575	420	133	15	95
29.9.66	Female	0.600	430	165	15	102
24.4.67	Female	0.500	360	120	11	80
10.6.67	Female	0.600	370	140	15	90
20.6.67	Male	0.950	432	163	24	108
Average		0.710	407.8	147	15.8	93.2

At birth the panther cub is a helpless little creature as its eyes are closed and the movements of the limbs are uncoordinated and rather random. The skin on nose-tip, paws and perineal area is mostly pink. The fur is short, the spots are faintly developed and the whiskers are black in colour. A cub emits a low cry when hungry or uncomfortable.

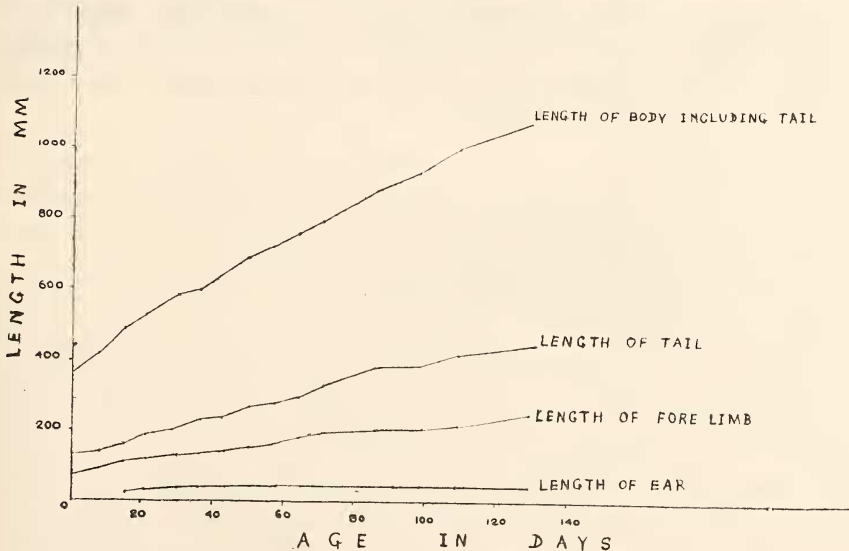


Fig. 2. Growth rate of body parts of cub born at Delhi Zoo (Table 5).

A panther cub born in 15th January 1966 was measured and weighed from birth till the age of 129 days when it was completely weaned and handling was no longer possible. Details of the measurements are given in table 5.

TABLE 5

GROWTH IN WEIGHT AND LENGTH OF PANTHER, *Panthera pardus*, BORN AT DELHI ZOOLOGICAL PARK

Age in days	Weight in kg	Total length in mm	Length of tail in mm	Length of forelimb in mm	Length of ear in mm
0	0.750	360	130	75	—
8	1.000	420	140	90	—
15	1.250	490	160	110	30
21	1.450	530	190	120	35
29	1.550	580	200	130	40
36	1.800	600	230	135	40
43	2.150	640	240	145	43
50	2.400	700	270	155	45
57	2.800	725	280	160	50
64	3.050	760	300	185	50
71	3.250	800	330	200	50
86	4.000	890	390	210	50
98	4.750	940	390	210	50
114	5.600	1010	420	220	50
129	6.250	1080	450	255	50

In Fig. 3, the growth rates of panther cubs hand-reared at Zurich and New York zoos are compared with those of young cubs reared by their mothers at Delhi Zoological Park and Sao Paulo Zoo, Brazil. Further details of the physical development and tooth eruption of panther cubs at Delhi Zoological Park, Sao Paulo Zoo, Brazil and New York Zoo, USA are given in Table 6.

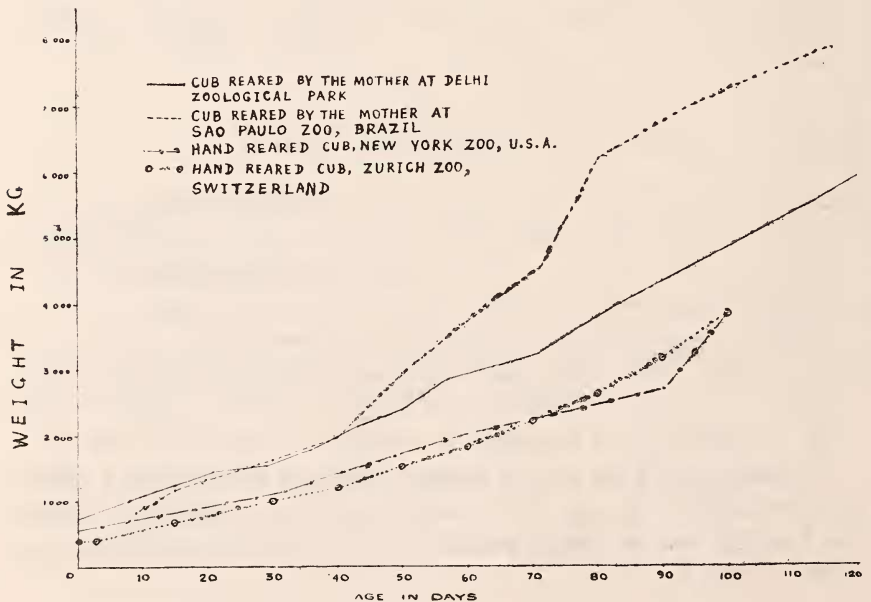


Fig. 3. Growth rate of cubs born at Delhi zoo compared with cubs in other zoos.



TABLE 6

COMPARISON OF PHYSICAL DEVELOPMENT OF PANTHER CUBS BORN AT DELHI ZOOLOGICAL PARK AND OTHER ZOOS

Specimen	Age in days when:					
	eyes open	incisors erupt	1st canine erupts	1st molar erupts	weaned	permanent canine erupts
Born at Sao Paulo Zoo Brazil on 18.7.1966	9	20	—	45	120-125	280
Born at New York Zoo, U.S.A. on 23.2.45	6	—	—	—	—	—
Born at Delhi Zoological Park (India) on 15.6.1966	8	21-29	29	52	114-129	—
Born at Delhi Zoological Park on 29.9.1966	4	22	30	53	—	—

## DISCUSSION AND CONCLUSIONS

Figure 1 shows that the panther breeds throughout the year and cubs are produced during all seasons in captivity. However, there is a peak period of births during the months of January, May and July, while February and November show a low percentage of births. During March not a single cub was born at Delhi Zoological Park between 1958 and 1973. This corresponds to the low breeding activities during December. According to the records of Whippsnade and Regent's Park from 1828 to 1961, the maximum number of births took place during the months of March, August and October while minimum births took place during January. The records of San Francisco zoo, USA, from 1929 to March 1967, show a high percentage of births during April and May and a low percentage during November, December, February and March (Reuther & Doherty 1968). The breeding records of panthers at Jaipur zoo indicate that from 1954 to 1963 not a single cub was born during the months of February and November (Sankhala & Desai 1969).

The records of San Francisco zoo and Jaipur zoo compare well with those of the Delhi Zoological Park. The variations in peak periods of

birth may be due to the different climatic conditions and local conditions.

2. All the larger felidae appear polyoestrus in captivity (Eckstein & Zuckermann 1956). Several authors (Asdell 1946; Eckstein & Zuckermann 1956; Sadlier 1966) give seven days as the duration of the oestrus period in lionesses. Sankhala (1967) states that the mating period of the tiger ranges from 3 to 23 days. Sadlier's data (1966) of three female panthers of three different types show mean length of oestrus for the species as 6.7 days.

The duration of oestrus varies from 4 to 14 days, according to the data of nine females at Delhi Zoological Park. There is also a wide range of individual variation among the pantheresses as shown in Table 2. It is not known whether age, physical condition, climate and frequency of copulation are responsible for such variations. The mean length of oestrus calculated from 55 oestrus periods of nine females is 8.1 days.

3. There is much individual variation in the age at which panthers attain sexual maturity. It appears that panthers become sexually mature at an age of between 2 and 4 years. However, no definite conclusion can be drawn from this small sample.

4. Well-adjusted pairs of panthers breed freely in captivity, but the first meeting involves risks of fatal injury. The mating behaviour of panthers is very similar to that of the tiger described by Sankhala (1967). The entire act of copulation lasts from one to three minutes but the actual coition takes only ten to fifty seconds. Mating takes place any time during the day. Panthers may mate five to sixty times in a day.

5. Data on 39 litters born at the Delhi Zoological Park from 1960 indicate a gestation period of 84 to 98 days with an average gestation of 91.9 days. This compares well with the gestation periods given by several authors (Asdell 1946; Kenneth 1953; Crandall 1964 and Prater 1971).

6. The ratio of number of cubs per litter shows that usually one or two cubs are born at a time in captivity. A litter of three cubs is born only occasionally. The average of 39 litters is 1.6 cubs per litter.

7. A newly-born panther weighs on an average 0.710 kg and measures 408 mm (Table 4). Its eyes are closed at birth and open any time from four to nine days later. It has no co-ordination of movements and cannot walk properly or stand upright. During the first four weeks it requires extreme care and nursing by the mother. Infant mortality occurs mostly during the first four weeks. The incisors are cut at the age of 21 to 29 days and the canines erupt at the age of 30 days. It starts licking and biting solid food when it is 52 days old and the first molar is cut. At the age of about 70 days, it starts taking buffalo calf meat or goat meat in captivity. In the beginning, nursing is frequent but the period of suckling at each feeding is reduced. As the cub grows, the fre-

quency of nursing is reduced but the period of suckling at each feeding increases. At the age of 70 days, it suckles only two to three times in a day. It is completely weaned at 114 to 130 days. The growth rate of the cubs reared by their mothers is much better than that of hand-reared cubs. This is evident from the data of cubs reared by their mothers at Delhi Zoological Park and Sao Paulo zoo, Brazil as compared to the hand-reared cubs of New York and Zurich zoos (Fig. 2).

There is much individual temperamental variation. Some mothers take good care of their cubs, others neglect them and some pantheresses even eat their own cubs. Cannibalism although not common, is prevalent among panthers even in well-managed zoos and needs further investigation. As a rule all pantheresses are very possessive and protective of their cubs and become very ferocious if they sense any danger to them.

The panther is one of our most magnificent and graceful animals. It is well adapted for survival in highly variable climates and habitats. Its short gestation period and reproductive potential suggest that under normal conditions it can maintain itself. However, with large-scale destruction of habitat due to industrialization and agriculture, depletion of its prey and indiscriminate poaching, it has a slender chance of survival in the wild. In order to evolve suitable measures for its protection further scientific study of the species in its natural habitat is desirable.

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